

**REMARKS**

Applicant cancels claims 3-5, 9, 11, 12 and 19-24 without prejudice or disclaimer, and adds new claim 26. Therefore, claims 1, 2, 6-8, 10, 13-18, 25 and 26 are now pending in the application. Applicant amends claim 1 more clearly to recite the features of the embodiment defined therein, rewrites claim 25 in independent form including the features recited in its independent base claim 19 (except for the feature of “a chamber” which is presented in the new dependent claim 26), and amends claims 10 and 14-17 to correct minor informalities. These amendments do not narrow the scope of the original claims 1, 10, 14-17 and 25. No estoppel is created.

The Examiner rejects under 35 U.S.C. §103(a):

- claims 1-6, 10 and 11 as being unpatentable over Kondo et al., “Fabrication Of Long-Period Fiber Gratings By Focused Irradiation Of Infrared Femtosecond Laser Pulses,” Optics Letters, Vol. 24, No/ 10, May 15, 1999 (Kondo) in view of Dianov et al. (Dianov);
- claim 7 as being unpatentable over Kondo in view of Dianov, and further in view of Kashyap;
- claim 8 as being unpatentable over Kondo in view of Dianov, and further in view of Kircher.
- claim 9 as being unpatentable over Kondo in view of Dianov, and further in view of Reekie et al. (Reekie);
- claim 12 as being unpatentable over Kondo in view of Dianov, and further in view of Adar et al. (Adar) and Froning et al. (Froning);
- claim 13 as being unpatentable over Kondo in view of Dianov, and further in view of Kershaw;
- claim 14 as being unpatentable over Kondo in view of Dianov, and further in view of Koops et al. (Koops);
- claims 15 and 16 as being unpatentable over Kondo in view of Dianov, and further in view of JP O7-294756 to Yamada et al. (Yamada);
- claim 17 as being unpatentable over Kondo in view of Dianov, and further in view of Yamada and Yamauchi et al. (Yamauchi);

- claim 18 as being unpatentable over Kondo in view of Dianov, and further in view of Koops, Kristensen et al. (Kristensen) and Bhagavatula;
- claim 19 as being unpatentable over Kondo in view of Dianov, and further in view of Kewitsch et al. (Kewitsch);
- claim 20 as being unpatentable over Kondo in view of Dianov, and further in view of Kewitsch, Kristensen and Bhagavatula;
- claim 21 as being unpatentable over Kondo in view of Dianov, and further in view of Kewitsch and Ooba et al. (Ooba);
- claim 22 as being unpatentable over Kondo in view of Dianov, and further in view of Kewitsch, Suzuki et al. (Suzuki) and Kenney et al. (Kenney);
- claim 23 as being unpatentable over Kondo in view of Dianov, and further in view of Kewitsch, Baney and Barbarossa et al. (Barbarossa);
- claim 24 as being unpatentable over Kondo in view of Dianov, and further in view of Kewitsch and Dianov et al., "Grating Formation In A Germanium Free Silicon Oxynitride Fibre," Electronics Letters, Vol. 33, No.3, January 30, 1997 (Dianov publication); and
- claim 25 as being unpatentable over Kondo in view of Dianov, and further in view of Hill et al. (Hill).

Also, the Examiner objects to the drawing figures allegedly because some of the reference numerals are not referenced in the specification, and some of the features recited in claims 12, 15 and 25 are not illustrated therein.

Finally, the Examiner objects to claims 12, 15-17, 21 and 23-25 due to minor informalities.

**Objections to the drawings**

Applicant respectfully submits that objections set forth in paragraphs 1 and 2 of the Office Action are addressed and overcome by the amendments to the specification as set forth above, and corrected Figs. 6 and 14 and new Figs. 19 and 20 included in the Proposed Drawing Corrections submitted herewith. Also, Applicant corrects minor labeling errors in 12, 14 and 15-18.

**Objections to the claims**

Applicant respectfully submits that these objections are overcome by the claim amendments set forth above.

**Prior art rejections**

Applicant respectfully traverses these rejections as follows.

Kondo discloses a method for fabricating long-period fiber gratings using focused irradiation of infrared femtosecond laser pulses having a pulse width of 120 femtoseconds. That is, in Kondo, the optical fiber is subjected to irradiation to form fiber gratings.

On the other hand, Dianov discloses a method for forming grating by irradiating UV laser light into a fiber light guide (not the optical fiber). Absent Applicant's own disclosure, one skilled in the art would not have been motivated to combine opposing teachings of Kondo and Dianov, let alone realize a method for forming gratings by irradiating ultra short pulse laser rays with a pulse width of not more than 30 pico-seconds as required by Applicant's independent claims 1 and 25.

That is, the object of both Kondo and Dianov is formation of gratings; however, one skilled in the art would not have been motivated to irradiate femtosecond laser pulses of Kondo into an optical wave-guide device for adjustment/modification of the refractive index.

On the other hand, in accordance with an aspect of Applicant's claimed invention, a device having an interference type already determined in the optical wave-guide may be improved by using the apparatus for modifying the refractive index.

Kondo discloses the use of laser light having, at a maximum, a pulse width of 120 femtoseconds, and does not disclose or suggest a longer pulse width. Kondo and Dianov neither

teach, nor suggest, the method for modifying refractive index and the saturation of the refractive index, as required by Applicant's independent claim 1.

Further, with regard to Applicant's claim 6, Kondo and Dianov disclose core layer having only one layer. Thus, dependent claim 6 is distinguishable from the combination of the cited references for this additional reason.

Further, with regard to Applicant's claims 7 and 8, Kashyap describes the effect of incident ultra-violet radiation to change the refractive index of the photosensitive cladding region 22a of fiber 20, in the region of the splice. In contrast, Applicant's claim 7 requires increasing the refractive index of the irradiated part by increasing the density of the irradiated part, while claim 8 requires reducing the refractive index of the irradiated part by decreasing the density of the irradiated part. Thus, dependent claims 7 and 8 are distinguishable from the combination of the cited references for this additional reason.

Further, with regard to Applicant's claim 13, forming a tapered core using the ultra short pulse laser is not disclosed or suggest by any of the cited references. Particularly, according to this embodiment of Applicant's invention, a core of the optical wave-guide having a three dimensional taper can be formed. None of the cited references teaches or suggests forming a core having the three dimensional taper by means of ultra short pulse laser. Thus, dependent claim 13 is distinguishable from the combination of the cited references for this additional reason.

Further, with regard to Applicant's claim 14, the core section includes a grating for diffracting rays transmitted in the core section to any direction using the ultra short pulse laser. None of the cited references teaches or suggests such a feature. Thus, dependent claim 14 is distinguishable from the combination of the cited references for this additional reason.

Further, with regard to claims 15 and 16, Yamada discloses a method for adjusting optical paths having more than three paths. Yamada does not teach or suggest a method for modifying a refractive index. One skilled in the art would not have been motivated to combine Yamada with Kondo and Dianov. Further, claim 15 requires that the core section in the optical wave-guide device includes a planar slab wave-guide for additionally forming a portion thereon having a higher refractive index. None of the cited references teaches such a feature. As to claim 16, Yamada discloses irradiation of UV laser for the adjustment of the directional coupler. Yamada does not disclose, teach or suggest the use of the ultra short pulse laser. Kondo discloses formation of grating in the optical wave-guide. Thus, one skilled in the art would not have been motivated to combine Yamada with Kondo and Dianov. Likewise, with regard to claims 17 and 18 one skilled in the art would not have been motivated to combine Kondo, Yamada, Dianov and Yamauchi. Thus, dependent claims 15-18 would not have been obvious from the cited references for these additional reasons.

With regard to Applicant's claim 25 which recites, *inter alia*, a surface shape of the optical wave-guide irradiated with the laser rays being convex to act as a lens, Hill does not disclose, teach or suggest such a feature. In fact, Hill simply discloses nothing more than an optical fiber having a round surface. In contrast, according to an embodiment of the invention as claimed in claim 25, the surface of the optical wave-guide is required to be convex so that the irradiated laser rays are focussed to the core section of the optical wave guide. Thus, Applicant's independent claim 25, as well as its dependent claim 26 (which incorporates all the novel and unobvious features of its base claim) would not have been obvious from any reasonable combination of the cited prior art.

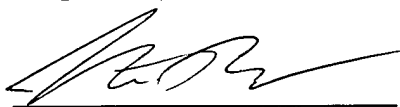
Amendment Under 37 C.F.R. § 1.111  
U.S. Appln No. 09/788,621

Atty Dkt No. Q63282

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned attorney at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

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